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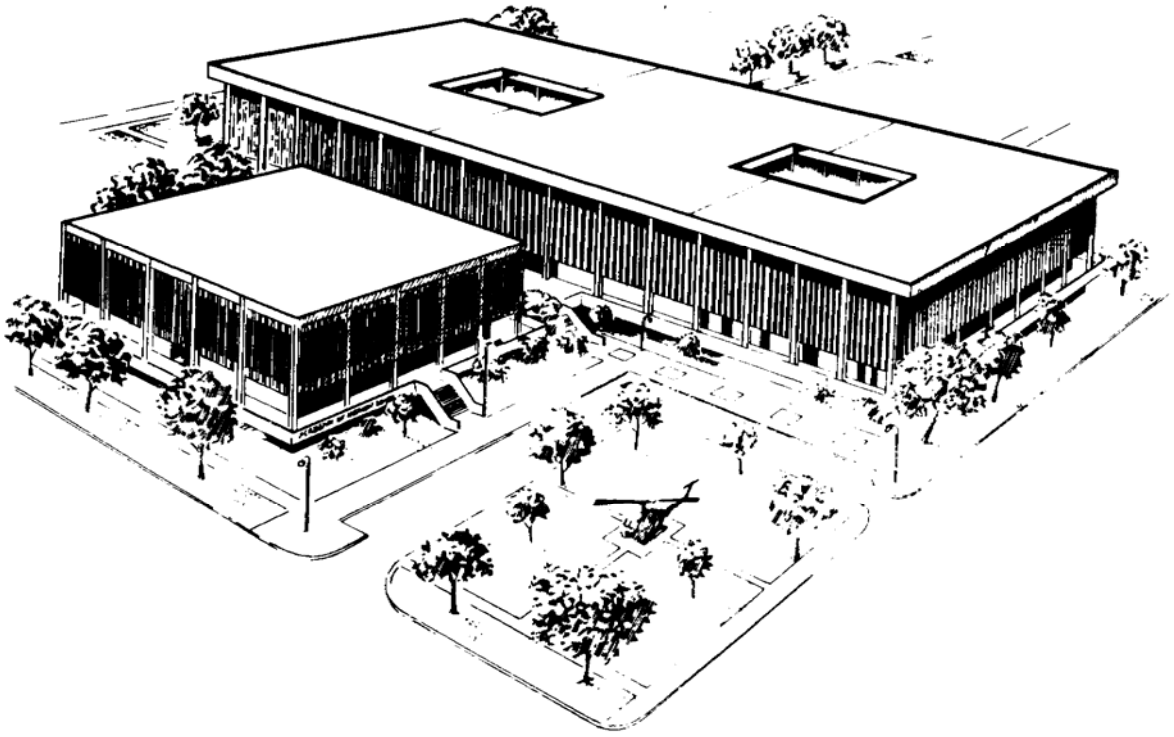
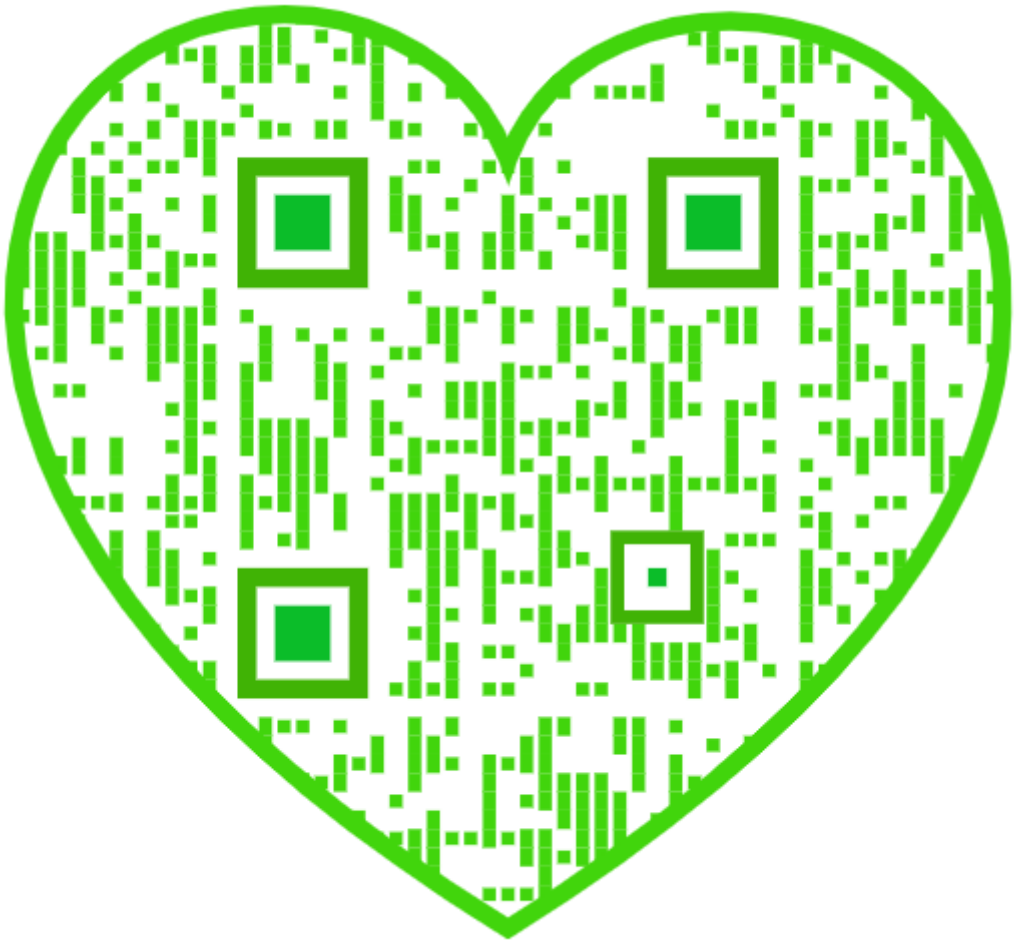


CHEST AND AIRWAY

PROBLEMS

SUBCOURSE MD0569 EDITION 200



DEVELOPMENT

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CORRESPONDENCE COURSE OF
THE U.S. ARMY MEDICAL DEPARTMENT CENTER AND SCHOOL

SUBCOURSE MD0569

CHEST AND AIRWAY PROBLEMS

INTRODUCTION

In this subcourse, you will study chest and airway problems. Chest trauma refers to general information about chest injuries as well as information about specific chest injuries. Airway problems includes information on devices -- nasopharyngeal airway (NPA), the Combitube™ and KING LT-D™ airway [which are both BIADS (blind insertion airway devices)], and the endotracheal tube (ET) -- that can be used to open and maintain an airway. If other life-saving methods are not successful in opening and maintaining an airway, an opening is made in the trachea to bypass the site of an upper airway obstruction. This subject matter is of vital importance in saving lives.

Subcourse Components:

This subcourse consists of three lessons:

Lesson 1, Chest Trauma.

Lesson 2, Airway Management.

Lesson 3, Cricothyroidotomy.

Credit Awarded:

Upon successful completion of the examination for this subcourse, you will be awarded eight credit hours.

To receive credit hours, you must be officially enrolled and complete an examination furnished by the Nonresident Instruction Section at Fort Sam Houston, Texas.

You can enroll by going to the web site http://atrrs.army.mil and enrolling under "Self Development" (School Code 555).

A listing of correspondence courses and subcourses available through the Nonresident Instruction Section is found in Chapter 4 of DA Pamphlet 350-59, Army Correspondence Course Program Catalog. The DA PAM is available at the following website: http://www.usapa.army.mil/pdffiles/p350-59.pdf.

LESSON ASSIGNMENT

LESSON 1	Chest Trauma
LESSON ASSIGNMENT	Paragraphs 1-1 through 1-13.
LESSON OBJECTIVES	After completing this lesson, you should be able to:

1-1. Identify common signs, common treatment, and general principles of treatment for chest injuries.

1-2. Define these specific chest injuries and identify the signs/symptoms and treatment of the specific chest injuries:

- Fractured ribs or sternum.
- Flail chest.
- Cardiac contusion.
- Hemothorax.
- Simple pneumothorax.
- Subcutaneous emphysema.
- Open pneumothorax.
- Tension pneumothorax.

SUGGESTION After completing the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 1

CHEST TRAUMA

Section I. GENERAL INFORMATION ABOUT CHEST INJURIES

1-1. INTRODUCTION

Chest injuries are of major importance because they are a common cause of death. Fifty percent of the people who expire from chest injuries die on the way to the hospital. The common causes of penetrating and nonpenetrating chest injuries include automobile accidents, falls and blows, gunshot wounds, stab wounds, and crushing injuries. In a chest injury, there is a possibility of internal bleeding and/or direct injury to the heart or lungs; therefore, any chest injury may be serious. Chest decompressions, chest thoracotomy, and other procedures may be used to save the casualty's life if they are performed correctly and in a timely manner. With specialized training and prescribed methods of treatment for various chest traumas, your ability to recognize and react quickly in each situation is an important factor in regard to whether the casualty survives.

1-2. COMMON SIGNS/SYMPTOMS OF CHEST INJURIES

The common signs and symptoms of chest injuries are:

a. A change in normal breathing pattern.

b. Pain at the site of the injury.

c. Dyspnea (shortness of breath).

d. Failure of the chest to expand.

e. A rapid/weak pulse.

f. Low blood pressure.

g. A dry cough or blood.

h. A sucking sound on respiration.

i. Cyanosis (bluish discoloration of the skin due to lack of oxygen).

j. Hemoptysis (spitting of blood from lesions in the larynx, trachea, or lower respiratory tract).

1-3. COMMON TREATMENT FOR CHEST INJURIES

Regardless of the type of chest injury, initial treatment is almost always the same. Begin by examining the casualty to detect the chest injury.

a. Question the casualty, if he is conscious, to see if he has difficulty in breathing.

b. Observe the casualty's bare chest and upper abdomen for respiratory rate and depth.

c. Check for equal movement of both sides of the casualty's chest.

d. Examine the entire chest wall (including the back) beneath any overlying clothing.

e. Listen to the casualty's chest with a stethoscope. Listen to both sides of the chest, comparing both sides for volume, loudness, and equality.

1-4. TYPES OF CHEST INJURIES

a. **Penetrating Injuries.** A penetrating injury may be a hole in the thoracic cavity that allows air inside the thorax, the air filling the thoracic cavity (pneumothorax). A penetrating injury may cause blood to flow into the thoracic cavity (hemothorax), filling the thorax with blood.

b. **Blunt Injuries.** Blunt injuries include rib and sternum damage, flail chest, and cardiac contusion.

c. **Results of Penetrating/Blunt Injuries**. Penetrating and blunt injuries can cause considerable damage. Both types of injury can cause air to build up outside the lung in the thoracic cavity (simple pneumothorax). In simple pneumothorax, the pressure is not great enough to cause the lung to collapse. A blunt injury or a penetrating injury may cause air to build up to such great pressure in the thoracic cavity that the lungs collapse (tension pneumothorax). Blunt trauma can also cause cardiac and lung bruising that can inhibit the ability for the oxygen exchange to occur.

1-5. GENERAL PRINCIPLES OF TREATMENT FOR CHEST TRAUMA

Follow these general principles in treating for chest trauma:

a. Aggressive management of the airway is the most important consideration in treating chest trauma.

b. After insuring a patent airway, your next priority is to secure the chest wall defect with an occlusive dressing. (The Asherman Chest Seal is very effective for this purpose, but traditional occlusive dressings are just as effective).

c. Keep the bronchial tree clear of retained blood, foreign material, and bronchial secretions by using suction as needed.

d. Positive pressure ventilation plays an important role in maintaining pleural pressure. If possible the patient should be intubated and ventilated.

e. Continuous evaluation of the patient's respiratory status to watch for signs of developing tension pneumothorax.

Section II. SPECIFIC CHEST INJURIES

1-6. FRACTURED RIBS OR STERNUM

a. **Fractured Ribs**. Fractured ribs are usually caused by blunt, direct blows or by compression injuries of the chest. The upper ribs are protected--in front by the clavicle, in back by the scapulae, on the side by the arms, and by the heavy muscles of the upper thorax and its appendages--and are rarely fractured. The fifth through the ninth ribs are most commonly fractured. The lower two ribs are attached to the thoracic vertebrae and have movement; therefore, they are rarely fractured.

b. **Fractured Sternum**. Fracture of the sternum occurs about once in every twenty chest injuries. Fractures of the sternum are an indication to look for other serious injuries because a blow hard enough to fracture the sternum will often cause serious damage in the thorax. Injuries associated with a fractured sternum include tracheal or bronchial tears, ruptured diaphragm or esophagus, flail chest, and contusion of the myocardium or lung.

c. **Signs/Symptoms of Fractured Ribs or Sternum.**

(1) Tenderness at the point where the casualty indicates pain.

(2) Pain that worsens when the casualty breathes or coughs.

(3) The casualty may be protecting the affected side by leaning toward that side with his hand protecting it or by splinting the affected side.

(4) Crepitus (grating sounds; sounds which can be heard when bones move against each other).

(5) Subcutaneous emphysema (a condition to be discussed later).

d. **Associated Complications.**

(1) Rupture or lacerations of underlying structures are common. If there is a direct blow to one or more ribs, there is a possibility that the rib ends may be driven into the lung underneath and the pleura, causing damage.

(2) Internal bleeding may be caused by fractured ribs.

(3) Shock.

e. **Treatment.** Treatment includes examining the casualty for underlying chest problems and giving him something for pain.

1-7. FLAIL CHEST

A flail chest occurs when three or more adjacent ribs are fractured in two or more places, resulting in a segment of the thoracic cage becoming detached. Flail chest (also called floating or crushed chest) is more common in today's era of high-speed automobile accidents. It is usually caused by a blunt blow to the ribs. If two or more ribs are broken in two places, the part of the chest wall between the breaks collapses and does not participate in the normal expansion of the chest each time the person inhales. When the casualty exhales, the part of the chest wall between the breaks will protrude while the rest of the chest wall contracts.

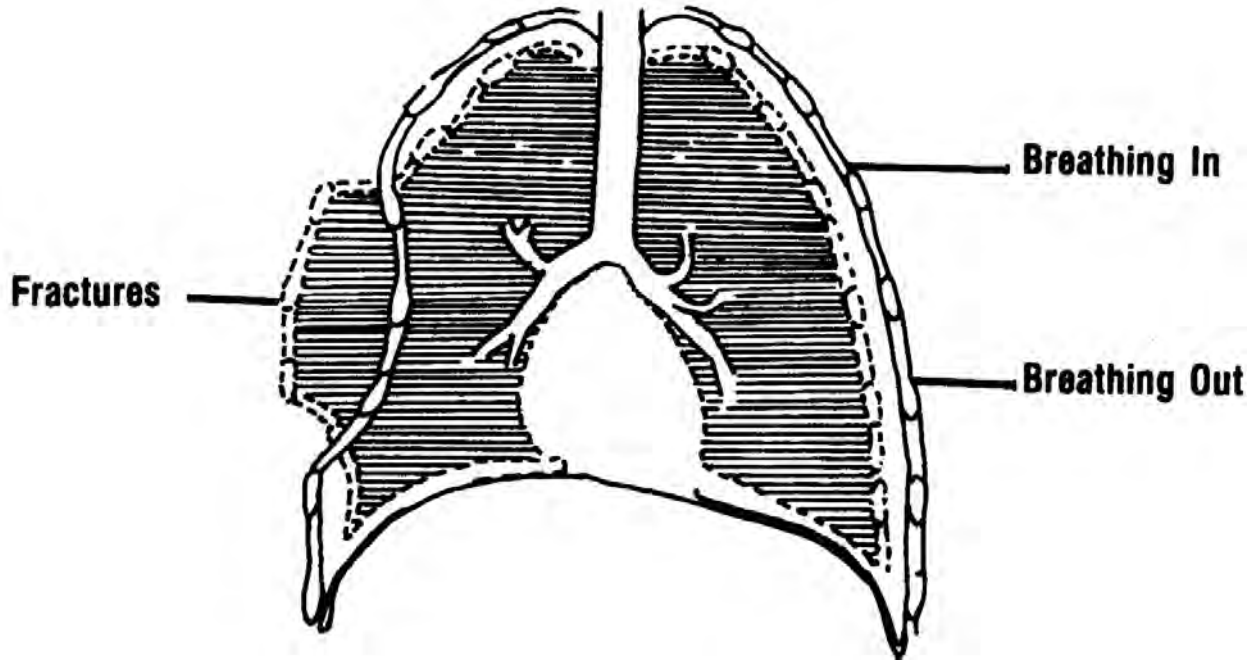

Figure 1-1. Flail chest--paradoxical respirations (active breathing).

a. **Signs/Symptoms.** Signs and symptoms of flail chest include the following:

(1) Pain at the site of the injury.

(2) Tachypnea (rapid breathing).

(3) Paradoxical respirations. For example, the chest expands with expiration (breathing out) and contracts with inhalation (breathing in).

b. **Treatment.** To administer initial treatment to a casualty with a flail chest injury, you should:

(1) Place your hand, a pillow, or another object on the flail segment to immobilize it.

(2) Strap or tape the pillow or other object in place.

(3) Give the casualty oxygen.

(4) Provide positive pressure ventilation. A patient with a flail segment will benefit greatly from positive pressure ventilation and is a prime candidate for rapid sequence intubation to accomplish this.

1-8. CARDIAC CONTUSION

Cardiac contusion is severe trauma to the anterior chest. This trauma results in bruising and irritation of the heart muscle. This injury is caused by a severe, blunt blow to the chest; for example, a steering wheel injury.

a. **Signs/Symptoms.** Cardiac signs and symptoms include:

(1) Exposed ribs and/or sternum.

(2) Cardiac dysrhythmia. Cardiac dysrhythmias may be detectable by an irregular pulse. The location of the injury often influences the types of dysrhythmias. An injury to the right side results in artial dysrhythmias. Injury to the left side or the front results in ventricular dysrhythmias.

b. **Management.** To manage a patient with cardiac contusion, you should:

(1) Be alert for possible cardiac arrest.

(2) Help the casualty avoid movement and conditions which could cause a change in heart rate.

(3) Stabilize the patient and evacuate immediately.

c. **Complication--Cardiac Tamponade.**

(1) Cardiac tamponade. Cardiac tamponade, complication of cardiac contusion, is a condition in which blood or other fluid which has leaked out of the heart in the chest injury is caught in the pericardial sac. The fluid accumulates and compresses the heart so that the chambers of the heart cannot hold the blood normally returned to it. This situation must be corrected immediately.

(2) Signs/symptoms of cardiac tamponade.

(a) Thready, rapid pulse.

(b) Converging systolic/diastolic blood pressure (upper and lower blood pressure readings come closer and closer together as successive readings are taken).

(c) Distended neck veins.

(d) Muffled heart sounds.

(e) Cool, pale, and clammy skin.

(f) Death may result due to inadequate cardiac output.

(g) Signs of a cardiac tamponade can resemble a tension pneumothorax, the determining factor in tamponade is equal breath sounds. If a patient is showing signs these signs and you are unable to determine the presence of breath sounds, the patient should receive a chest needle decompression to relieve pressure.

1-9. HEMOTHORAX

Hemothorax is hemorrhaging within the thorax due to the rupture of blood vessels in the chest. The chest is filled up with something other than the lungs. The result is that the lungs cannot expand normally. The casualty is not able to inhale as much air, and there may be less blood to carry this reduced amount of oxygen through the casualty's body. A common cause of hemothorax is a penetrating object to the chest.

a. **Signs/Symptoms of Hemothorax.** Signs and symptoms include the following:

(1) Respiratory difficulty such as dyspnea or gasping respiration.

(2) Decreased, absent, or hyporesonance (dull) respiratory sound.

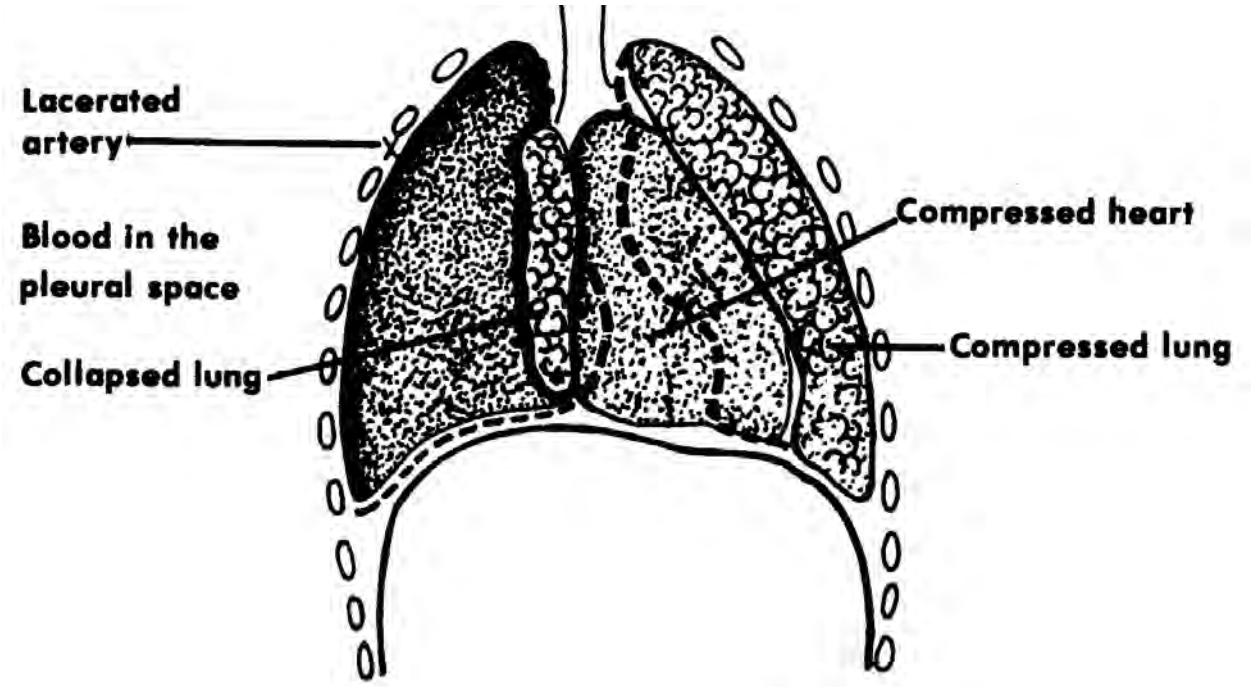

Figure 1-2. Hemothorax.

(3) Early and severe signs of hypovolemia (abnormally diminished volume of blood circulating in the body) and shock to include:

(a) Loss of up to three liters of blood, possibly in a short period of time.

(b) Low blood pressure.

(c) Increased heart rate.

(4) A chest x-ray will show:

(a) Collapse of a lung.

(b) Fluid in the pleural space.

b. **Treatment for Hemothorax.** To treat for hemothorax, you should:

(1) Treat for shock. Follow the general principles of treating for hypovolemic shock (shock caused by diminished blood volume). Start an intravenous infusion (IV) to replace lost body fluid.

(2) Administer oxygen.

c. **Treatment for Hemothorax.** Follow the general principles of treating for hypovolemic shock (shock caused by a decrease in the amount of blood circulating in the body).

(1) Survey the casualty and maintain the airway, if necessary.

(2) Reassure the casualty.

(3) Position the casualty. Place the casualty in the Fowler's position (elevate the casualty's head about 20 inches) or the position of greatest comfort for the patient.

(4) Administer oxygen. Establish an airway (clear the casualty's airway of obstructions and/or secretions and insert an oropharyngeal or endotracheal tube (ET), if necessary). Then administer oxygen by mask or nasal catheter.

(5) Initiate intravenous infusion. IAW TC3 protocols for hypovolemic fluid resuscitation.

(6) Maintain the casualty's normal body temperature.

(7) Check vital signs. Check the casualty's vital signs and other symptoms as often as possible to see if he is responding to treatment. Check for consciousness, blood pressure, pulse rate, respirations, and skin color.

(8) Evacuate the casualty. Record the treatment and evacuate the casualty to the nearest medical facility as soon as possible.

(9) DO NOT drain the pleural space while you are in the field.

(10) Prepare the soldier for evacuation to a facility or location where an immediate chest tube thoracotomy can be initiated.

1-10. SIMPLE PNEUMOTHORAX

Simple pneumothorax is the presence of air within the pleural space. It results from blunt or penetrating trauma. Ninety percent of such injuries are associated with blunt trauma to the ribs. The fractured rib(s), in turn, cause injury to the pleura.

a. **Signs/Symptoms of Simple Pneumothorax.** Signs and symptoms include the following:

(1) Pain that is sudden and sharp (in spontaneous pneumothorax).

(2) Diminished or absent breath sounds.

(3) Hyperresonance (exaggerated sound) on the affected side as detected by percussion.

(4) Dyspnea (labored breathing) or gasping respiration.

(5) A dry cough.

b. **Treatment of Simple Pneumothorax.** To treat simple pneumothorax, you should:

(1) Maintain the airway.

(2) Administer oxygen.

(3) Cover the wound with an occlusive material.

(4) If the wound is small, the vital signs are stable, and there is no respiratory distress, transport the casualty in a position that is comfortable for him.

(5) If the wound is large, perform chest decompression. Symptoms of a large wound are:

(a) Marked respiratory distress.

(b) Tachycardia (rapid pulse).

(c) Hypotension (low blood pressure).

1-11. SUBCUTANEOUS EMPHYSEMA

The presence of air or gas in the subcutaneous tissues is called subcutaneous emphysema. This condition can be caused by a blow to the chest which has caused a lung laceration from a fractured rib or from an injury to the trachea. If the chest injury is very severe, subcutaneous emphysema can involve the entire chest, neck, and face.

a. **Signs/Symptoms of Subcutaneous Emphysema.** The signs and symptoms include the following:

(1) Soft-tissue crepitus. As you feel over the area of the fracture with your fingertips, you will feel skin that seems like Rice Krispies®.

(2) Occasionally, you will hear crackling sounds when you auscultate the chest.

b. **Treatment of Subcutaneous Emphysema.** To treat subcutaneous emphysema, you should:

(1) Determine the underlying injury--fractured rib, lung laceration, tracheal rupture, etc, and treat the injury.

(2) Have the casualty rest.

(3) Monitor respiration.

(4) Administer oxygen. If you use the highest concentration possible, you may reduce the signs and symptoms.

(5) Prepare the casualty for endotracheal intubation in the case of a tracheal rupture; often this will place the ET beyond the site of the rupture alleviating the problem.

1-12. OPEN PNEUMOTHORAX

Open pneumothorax, also called sucking chest wound, occurs as a result of an external penetrating trauma such as a shotgun wound at close range. The gunshot lacerates (tears) the flesh leaving an open wound. The open wound allows air to enter the chest cavity through the wound each time the casualty inhales and the chest expands in the normal respiratory cycle. In this situation, the air remains outside the lung in the pleural space. When the casualty exhales, air goes back outside through the wound. The lung, due to air in the pleural space, has not been able to fill and function properly.

a. **Signs/Symptoms of Open Pneumothorax.**

(1) Bloody froth in the wound when the casualty breathes out.

(2) A sucking sound at the wound site each time the casualty breathes in.

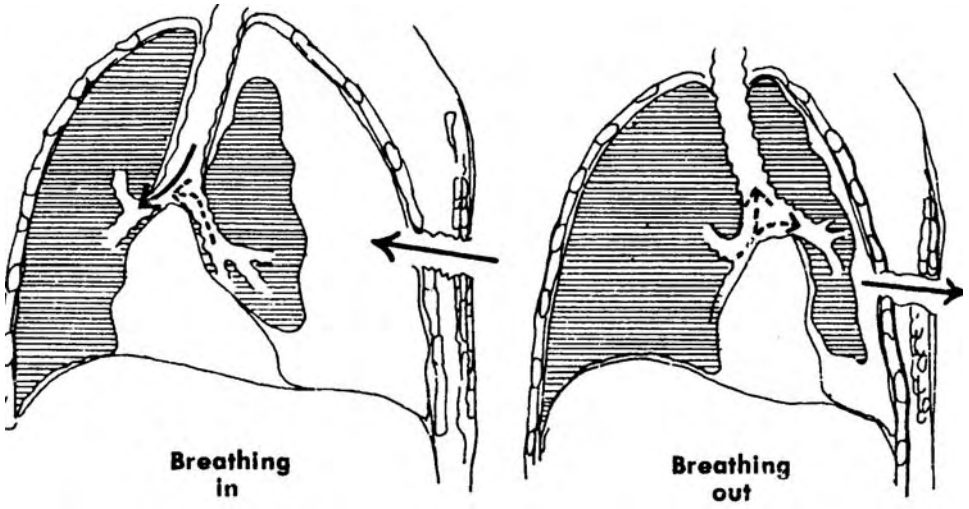

Figure 1-3. Open pneumothorax.

b. **Treatment for Open Pneumothorax.** To treat for open pneumothorax, you should:

(1) Seal the wound immediately with your hand or any available material. The goal is to seal the wound; therefore, use a nonporous material, if possible, such as aluminum foil, or a dressing wrapper. An Asherman Chest Seal is also an excellent choice, if available. Be sure the dressing is large enough to cover the wound; otherwise, the dressing might be sucked into the wound.

(2) As soon as possible, apply petroleum gauze dressing on the wound and cover the dressing with a bulky dressing taped in place.

(3) Administer oxygen with positive pressure, as needed.

(4) Place the casualty in the semi-Fowler's position or any other position that is comfortable. If he is unconscious, lay him on his injured side.

(5) Observe the casualty for signs and symptoms of shock.

(6) Evacuate the casualty immediately.

(7) Carefully monitor the casualty for signs of a life threatening tension pneumothrorax.

1-13. TENSION PNEUMOTHORAX

Tension pneumothorax, a complication of hemothorax and pneumothorax, is a type of pneumothorax in which the intra-pleural pressure is greater than the atmospheric pressure. A leak in the lung has occurred, and that leak has failed to seal when the lung collapsed. With every breath the casualty takes, air continuously leaks out of the lung into the chest cavity. The lung collapses more with every breath until finally the lung is a small ball, perhaps two or three inches in diameter. This condition will be fatal if it is not corrected.

a. **Characteristics of Tension Pneumothorax.**

(1) The margins or edges of the tear in the pleura are positioned to form a one-way valve. This valve permits air to enter the pleural sac during inspiration (breathing in) but prevents air from escaping during expiration (breathing out) so that each excursion (breath) tends to increase the pressure in the chest. This causes the other lung and the heart to be compressed.

(2) Additionally, the heart and mediastinum are pushed away from the injured side.

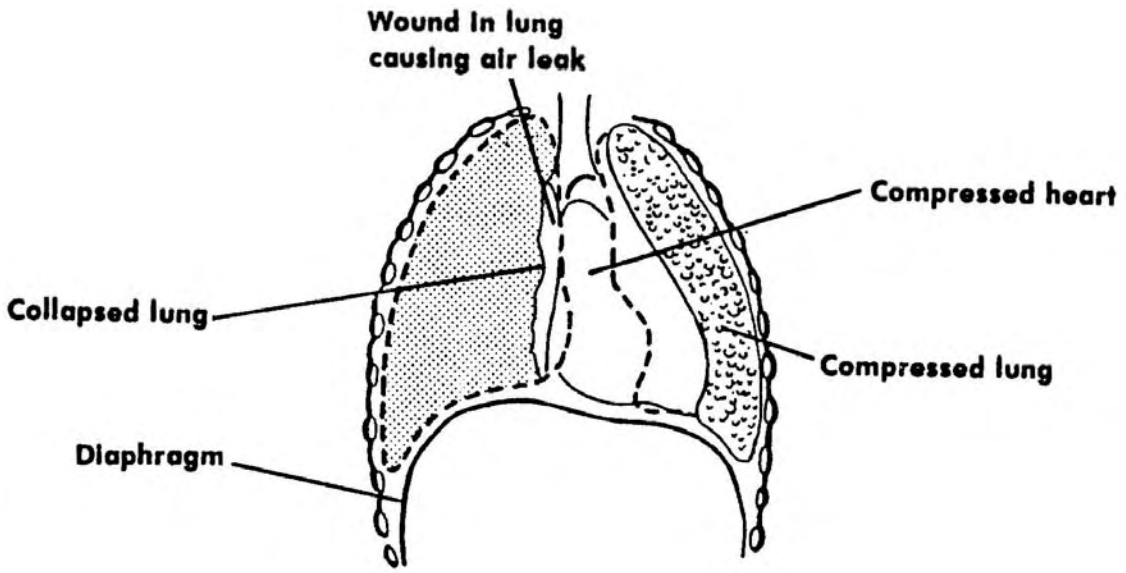

Figure 1-4. Tension pneumothorax.

(3) Ventilation (air in lungs is exchanged with atmospheric air) and circulation are impaired.

b. **Signs/Symptoms of Tension Pneumothorax.**

(1) Rib fracture or a penetrating wound.

(2) Progressive respiratory distress.

(3) Subcutaneous emphysema. Refer to paragraph 1-11. In this case, there is severe involvement of the entire chest, face, and neck. The area may appear grotesque and/or bloated.

(4) Pain on the affected side.

(5) The affected side will appear more prominent and move less. Air will remain trapped within the pleural cavity on exhalation.

(6) Breath sounds will be distant or absent on the affected side.

(7) Percussion reveals hyperresonance (exaggerated resonance on the affected side).

(8) Progressive distention of the abdomen that is not relieved by gastric aspiration (removal of fluids from the stomach) and endotracheal intubation.

(9) Deep cyanosis (bluish discoloration of the skin caused by insufficient oxygen in the blood).

(10) Shock.

c. **Treatment of Tension Pneumothorax.**

(1) Perform needle thoracentesis, if required. A needle thoracentesis is a method of removing air or fluids by suction (aspirating) by surgical puncture of the chest wall into the parietal cavity. To perform needle thoracentesis, follow these steps.

(a) Gather equipment according to local standing operating procedure (SOP).

(b) Locate the proper site of entry by counting ribs. The primary site is the second intercostal space (ICS) in the mid-clavicular line. Other sites are useful as well, it is possible to evacuate air from the chest any where from the 2nd ICS to the 5th ICS mid-axillary. It is important to move towards the lateral aspect of the thorax as you move down the chest to avoid the lungs and pericardium.

(c) Aspirate air or fluid from the chest cavity. This may take 30 or more seconds to evacuate the air, so take your time when conducting this procedure.

(2) Perform chest decompression.

(a) Place a 14 gauge 3-3.5” needle over the 3rd rib in to the 2nd ICS.

(b) STOP advancing the catheter as soon as the “pop” through the pleural space is felt.

(c) Leave the catheter in place and expel all air from the chest cavity.

(d) At this point the needle and catheter can be completely removed, or an alternative method is to leave the catheter in place.

(e) Monitor the patient closely since the WILL require follow on needle decompression. The definitive treatment is the chest tube thoracotomy.

(3) Perform a tube thoracotomy using the second incostal mid-clavicular line. This procedure is a must if the casualty is to be air-transported.

(4) Give the highest concentration of oxygen possible. Use positive pressure as needed. The positive pressure may increase tension; however, if decompression has been accomplished (air removed from the chest cavity), the lungs may expand.

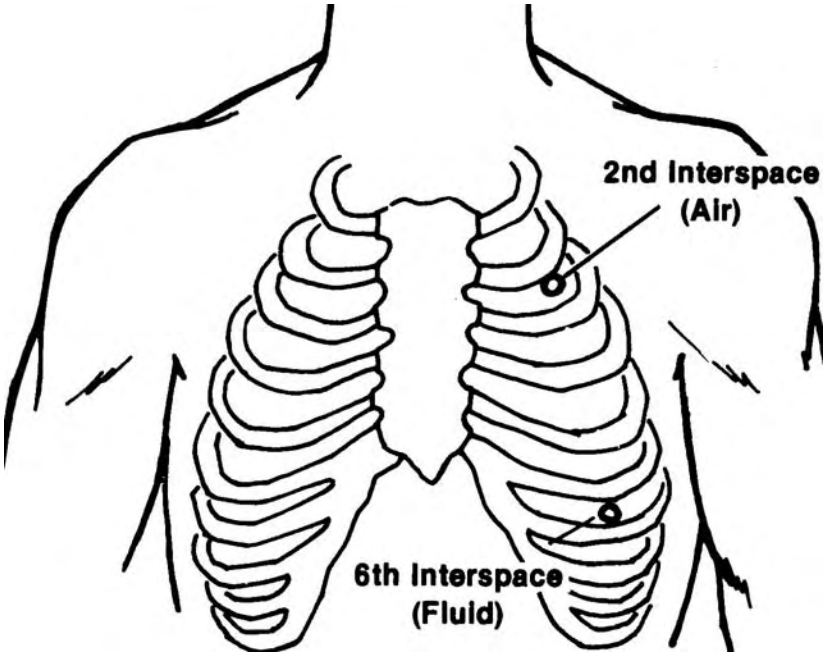

Figure 1-5. Needle insertion site for tension pneumothorax.

(5) Place the casualty in the Fowler's position, as tolerated.

(6) Start an IV using normal saline or Ringer's solution.

(7) Monitor the casualty's cardiac rhythm.

Continue with Exercises

EXERCISES, LESSON 1

INSTRUCTIONS. Answer the following exercises by writing the answer in the space provided.

After you have completed all of these exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers. For each exercise answered incorrectly, reread the material referenced with the solution.

1. List three common causes (listed in this lesson) of penetrating/nonpenetrating chest injuries.

   a. _____.

   b. _____.

   c. _____.

2. List four common signs/symptoms of chest injuries.

   a. _____.

   b. _____.

   c. _____.

   d. _____.

3. When you examine a casualty to detect a chest injury, you should:

   a. Question the casualty if he is _____ .

   b. Observe the casualty's bare chest and upper abdomen for _____ and depth.

   c. Check for _____ on both sides of the chest.

   d. Examine the _____(including the back) beneath any overlying clothing.

   e. Listen to the casualty's chest and compare both sides of the chest for _____, _____, and equality.

4. Rib and sternum damage, flail chest, and cardiac contusion are examples of _____ chest injuries.

5. A penetrating chest injury may be a hole in the thoracic cavity that allows _____.

6. When treating chest trauma, suction to keep the bronchial tree clear of retained blood, _____, and bronchial secretions.

7. _____ is a chest injury in which the pressure in the pleural cavity is greater than the atmospheric pressure.

8. A casualty with a chest injury is experiencing paradoxical respirations (the chest expands when he exhales and the chest contracts when he inhales). The casualty probably has a _____.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 1

1. You are correct if you listed any three of the following:

   Automobile accidents.
   Falls.
   Gunshot wounds.
   Stab wounds.
   Crushing injuries. (para 1-1)

2. You are correct if you listed any four of the following:

   Change in normal breathing pattern.
   Pain at injury site.
   Dyspnea (shortness of breath).
   Chest doesn't expand.
   Rapid/weak pulse.
   Low blood pressure.
   Dry or bloody cough.
   Sucking sound on respiration.
   Cyanosis.
   Hemoptysis. (paras 1-2a through 1-2j)

3. a. Conscious.
   b. Respiratory rate.
   c. Equal movement.
   d. Entire chest wall.
   e. Volume, loudness. (paras 1-3a through 1-3e)

4. Blunt. (paras 1-6a, 1-7, 1-8)

5. Air enter the thorax thus filling that cavity with air. (para 1-4a)

6. Foreign material. (para 1-5c)

7. Tension pneumothorax. (para 1-13)

8. Flail chest. (paraa 1-7, 1-7a(3))

End of Lesson 1

LESSON ASSIGNMENT

LESSON 2 Airway Management.

LESSON ASSIGNMENT Paragraphs 2-1 through 2-18.

LESSON OBJECTIVES After completing this lesson, you should be able to:

2-1. Identify the advantages and disadvantages of using the nasopharyngeal airway.

2-2. Identify the indications and contraindications of using nasopharyngeal airway.

2-3. Identify the procedures for the proper insertion of the nasopharyngeal airway.

2-4. Identify the advantages and disadvantages of the Combitube and the KING LT-D.

2-5. Identify the indications, contraindications, and warnings of using the Combitube and the KING LT-D.

2-6. Identify the procedures for the proper insertion and removal of the Combitube and the KING LT-D.

2-7. Identify the advantages/disadvantages of using an endotracheal tube.

2-8. Identify the indications/contraindications of using an endotracheal tube.

2-9. Place the steps for intubating with an endotracheal tube in the correct order of performance.

2-10. Place the steps for extubating an endotracheal tube in the correct order of performance.

SUGGESTION After completing the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.

Section I. NASOPHARYNGEAL AIRWAY

2-1. INTRODUCTION

A nasopharyngeal airway (NPA) is a tube inserted into the nasal passage that travels through the nasopharynx into the oropharynx to keep the tongue from blocking the airway. There are advantages to using the nasopharyngeal airway instead of the oropharyngeal airway. The NPA does not elicit a gag reflex in a patient who is semi-conscious and the NPA will remain in its proper place much better than the oropharyngeal airway.

2-2. ADVANTAGES/DISADVANTAGES OF NPA

a. **Advantages of the NPA.** The major advantage of the NPA is ease of placement. The airway adjunct can be lubricated and easily emplaced in the nasal passage to secure an airway. The airway does not elicit a gag reflex in most patients who are semi-conscious and even those who are fully conscious. The NPA can be trusted to stay in place fairly well with little additional observation (unlike the OPA which can be dislodged or could cause the patient to gag).

b. **Disadvantages of the NPA.** The major disadvantage of the NPA is that it does not create a secure airway that isolates the trachea from aspiration of fluids or stomach contents. The NPA cannot be used on patients with suspected basal skull fractures due to the possibility of introducing the NPA into the cranial cavity. You may encounter difficulty placing the NPA if the patient has nasal fractures or has a deviated septum.

2-3. INDICATIONS/CONTRAINDICATIONS FOR USE OF NPA

a. **Indications.** Any patient that has an altered mental status needs to have some form of an airway adjunct emplaced to ensure a patent airway.

b. **Contraindications.**

(1) As previously stated, signs and symptoms of a basal skull fracture is a contraindication for the NPA.

(2) Inability to insert the airway easily may be a contraindication. If resistance is met, try the other nostril. If resistance is still met then another method should be considered.

2-4. INSERTION OF THE NPA

a. Select proper size by measuring from the tip of the casualty's nose to the earlobe. Measure the diameter of the airway by comparing it to the size of the patient’s pinky finger.

b. Inserting a nasopharyngeal airway.

(1) Select the proper sized airway and coat the tip with a water-soluble lubricant.

(2) Gently stretch the larger nostril open.

(3) Place the airway in the larger nostril, with the bevel toward the nasal septum.

(4) Gently insert the airway ensuring the curvature of the device follows the curve of the floor of the nose.

(5) Insert until the flange rests against the nostril.

(6) If you encounter any resistance, remove the airway and insert it into the other nostril.

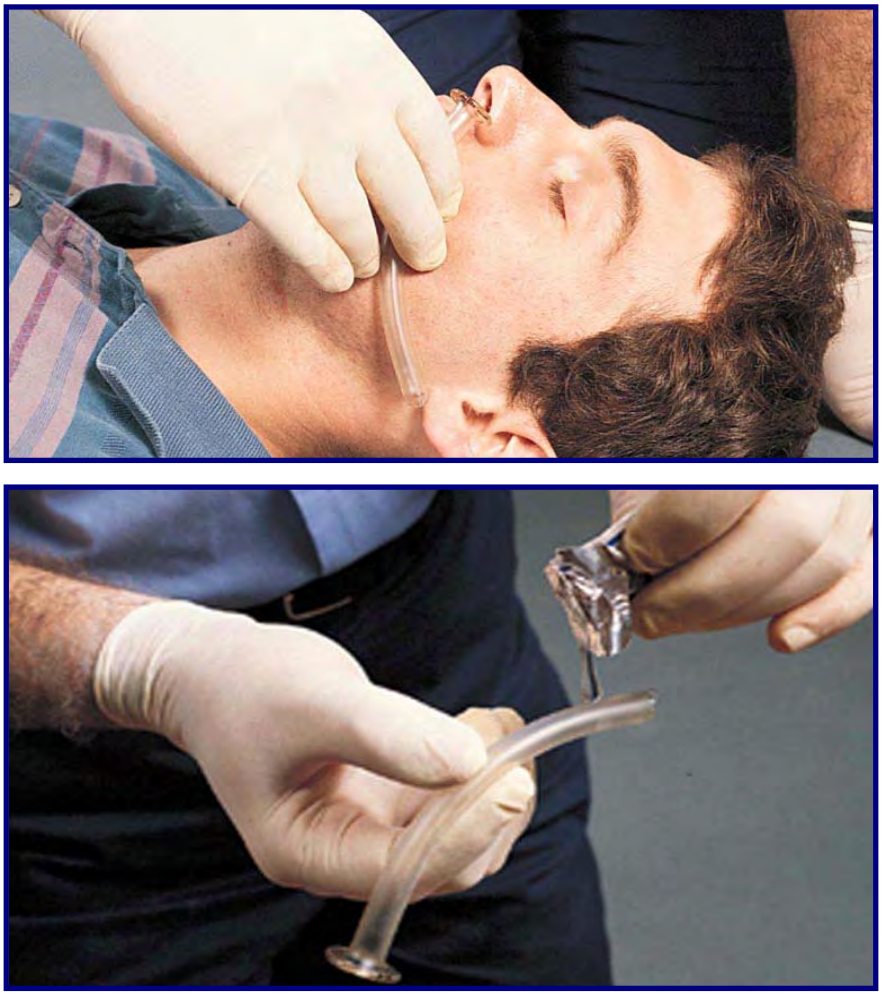

Figure 2-1. Proper measuring and lubrication of the NPA.

Figure 2-2. Proper insertion of the NPA.

Section ll. COMBITUBE™ AND KING LT-D™ AIRWAYS

2-5. INTRODUCTION

The Combitube™ and KING LT-D™ airways are both BIADs (blind insertion airway devices). The Combitube is a dual lumen airway which means it can be inserted into the trachea or the esophagus and still work effectively. The KING LT-D is a single lumen airway designed so that it can only be inserted into the esophagus, but protects the trachea to allow for ventilation of the patient.

2-6. ADVANTAGES/DISADVANTAGES OF BIADS

a. **Advantages.** BIADs can be inserted easily with little training and only one piece of additional equipment (a large syringe to fill the balloons). The skill required to insert a BIAD is easily retained with minimal training. The insertion does not require the use of light that could be detrimental in the battlefield environment. These are the airways of choice in the tactical field care phase of TC3.

b. **Disadvantages.** BIADs do not isolate the trachea, which could allow for aspiration. If the airway is not inserted properly (it is inserted in to the trachea), it could become an airway obstruction and inhibit the ability to ventilate the patient. BIADs can initiate the gag reflex and cause vomiting.

2-7. INDICATIONS.

Any patient with an altered mental status and lacking a gag reflex should be considered a prime candidate for a BIAD. These patients can not protect there own airways.

2-8. COMBITUBE AIRWAY

The Combitube is a twin lumen device designed for use in emergency situations and difficult airways. It can be inserted without the need for visualization into the oropharynx and usually enters the esophagus. The airway comes in two sizes, 37 Fr and 41 Fr.

2-9. INDICATIONS/CONTRAINDICATIONS FOR USE OF COMBITUBE AIRWAY

a. **Indications.** The Combitube may be used on adult casualties in respiratory distress or casualties in cardiac arrest

b. **Contraindications.** The Combitube should not be used on adults less than five feet in height, on anyone with known esophageal disease or caustic substance ingestion, or on a casualty with intact gag reflex.

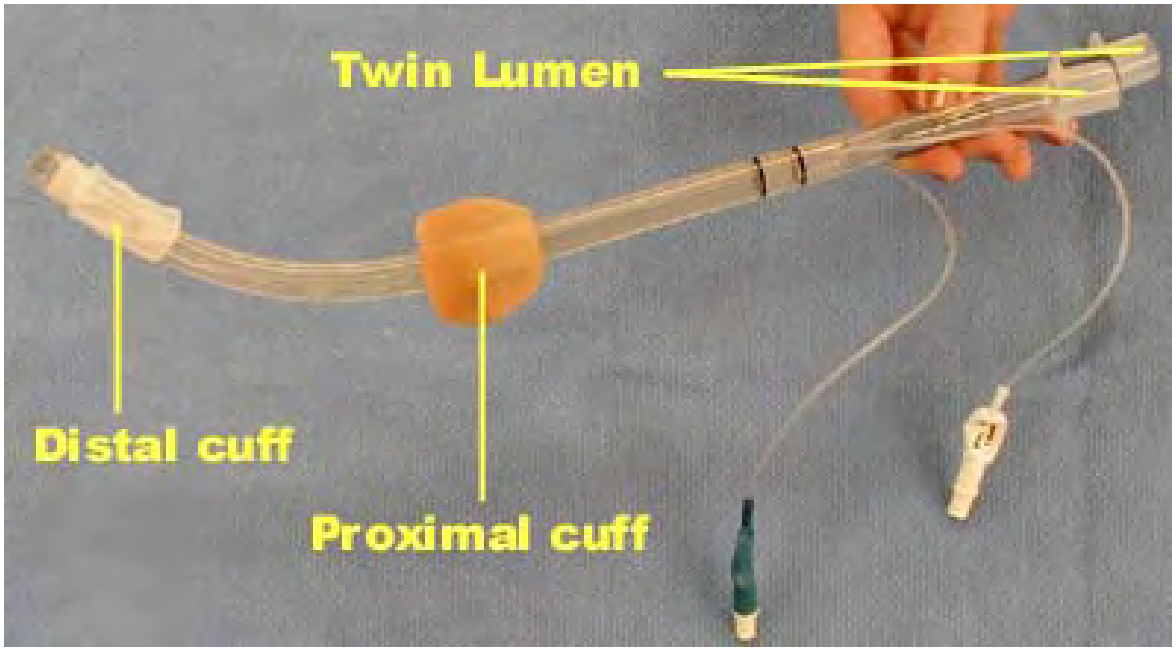

Figure 2-3 The Combitube airway.

2-10. INTUBATION PROCEDURES AND PRECAUTIONS OF COMBITUBE AIRWAY

a. Inspect the upper airway for visible obstructions.

b. Hyperventilate (more than 20 breaths per minute) for 30 seconds.

c. Place the casualty in a neutral head position.

d. Test both cuffs: 15 ml (white), 100 ml (blue).

e. Insert the tube in the same direction as the natural curvature of the pharynx.

(1) Grasp the tongue and lower jaw between your thumb and index finger, then lift upward (jaw-lift).

(2) Insert the tube gently but firmly until the black rings are positioned between the casualty's teeth.

(3) Do not force the tube. If does not insert easily, withdraw and retry.

(4) Hyperventilate between attempts.

f. Inflate #1 (blue) pilot balloon with 100 ml of air (100 ml syringe).

g. Inflate #2 (white) pilot balloon with 15 ml of air (20 ml syringe).

h. Ventilate through the primary #1 blue tube. If auscultation of breath sounds is positive (gastric sounds is negative), continue to ventilate

i. If auscultation of breath sounds through the primary #1 blue tube is negative and gastric sounds is positive, immediately begin ventilations through the shorter (white) connecting tube (#2).

j. Confirm tracheal ventilation of breath sounds and absence of gastric insufflation.

k. If auscultation of breath sounds and auscultation of gastric insufflation is negative, the Combitube may have been advanced too far into the pharynx.

(1). Deflate the #1 balloon/cuff, and move the Combitube approx. 2-3 cm. out of the casualty's mouth.

(2) Re-inflate the #1 balloon and ventilate through the longer (#1) connecting tube; if auscultation of breath sounds is positive and auscultation of gastric insufflation is negative – continue to ventilate.

l. If breath sounds are still absent – extubate.

m. Combitube should not be removed unless:

(1) Tube placement cannot be determined.

(2) Casualty no longer tolerates the tube.

(3) Casualty vomits past either distal or pharyngeal tube.

(4) Palpable pulse and casualty breathing on his own.

(5) Physician or PA is present to emplace ETT.

n. To remove a Combitube:

(1) Have suction available and ready.

(2) Logroll casualty to side (unless spinal-injured).

(3) Deflate the pharyngeal cuff (#1 pilot balloon).

(4) Deflate the distal cuff (#2 pilot balloon).

(5) Gently remove Combitube while suctioning.

2-11 KING LT-D AIRWAY

a. **Description.** The KING LT-D is a single use device intended for airway management. It consists of a curved tube with ventilation apertures located between two inflatable cuffs. Both cuffs are inflated using a single valve/pilot balloon. The distal cuff is designed to seal the esophagus and the proximal cuff is intended to seal the oropharynx. Attached to the proximal end of the tube is a 15 mm connector for attachment to a standard breathing circuit or resuscitation bag.

(1) Two ventilation outlets. Two ventilation outlets are located in front of the larynx for efficient ventilation. They allow passage of a fiberoptic bronchoscope or tube exchange catheter.

(2) Proximal cuff**.** The proximal cuff stabilizes the tube and seals the oropharynx.

(3) Pilot balloon**.** The pilot balloon inflates both cuffs.

(4) Distal cuff**.** The distal cuff blocks the entry of the esophagus. This reduces the possibility of gastric insufflation.

(5) Bi-lateral eyes**.** Additional eyelets are used to supplement ventilation.

b. **Indications for Use.** The KING LT-D is intended for airway management in patients over 4 feet in height (122 cm) for controlled or spontaneous ventilation.

c. **Contraindications.** The KING LT-D does not protect the airway from the effects of regurgitation and spiration. The following contraindications are applicable for routine use of the KING LT-D.

(1) Responsive patients with an intact gag reflex.

(2) Patients with known esophageal disease.

(3) Patients who have ingested caustic substances.

d. **Warnings.** The user should be familiar with the following warnings when considering or attempting to use the KING LT-D.

(1) High airway pressures may divert gas either to the stomach or to the atmosphere.

(2) Intubation of the trachea cannot be ruled out as a potential complication of the insertion of the KING LT-D. After placement, perform standard checks for breath sounds and utilize an appropriate carbon dioxide monitor as required by protocol.

(3) Lubricate only the posterior surface of the KING LT-D to avoid blockage of the aperture or aspiration of the lubricant.

e. **KING LT-D Insertion Procedures.**

(1) Using the information provided, choose the correct KING LT-D size based upon the patient's height.

(2) Test the cuff and inflation system for leaks by injecting the maximum recommended volume of air into the cuffs (size 3 -- 60 ml; size 4 -- 80 ml; size 5 -- 90 ml). Remove all air from both cuffs prior to insertion.

(3) Apply lubricant to the beveled distal tip and posterior aspect of the tube, taking care to avoid introduction of lubricant in or near the ventilatory openings.

(4) Have a spare KING LT-D ready and prepared for immediate use.

(5) Pre-oxygenate, if possible.

(6) Position the patient's head. The ideal head position for insertion of the KING LT-D is the “sniffing position.” However, the angle and shortness of the tube also allows it to be inserted with the head in a neutral position.

(7) Hold the KING LT-D at the connector with your dominant hand. Use your nondominant hand to hold the patient's mouth open and apply chin lift.

(8) With the KING LT-D rotated laterally 45 to 90 degrees such that the blue orientation line is touching the corner of the mouth, introduce the tip into the patient's mouth and advance behind the base of the tongue.

(9) As the tube tip passes under tongue, rotate the tube back to midline (blue orientation line faces chin).

(10) Without exerting excessive force, advance the tube until the base of the connector is aligned with the teeth or gums.

(11) Using the syringe provided, inflate the cuffs of the KING LT-D with the appropriate volume: size 3 -- 60 ml, size 4 -- 80 ml, size 5 --80 ml.

(12) Attach the resuscitator bag to the 15 mm connector of the KING LT-D. While gently bagging the patient to assess ventilation, simultaneously withdraw the KING LT-D until ventilation is easy and free flowing (large tidal volume with minimal airway pressure).

Figure 2-4. The KING LT-D.

Figure 2-5. KING LT-D insertion.

(13) Depth markings are provided at the proximal end of the KING LT-D that refer to the distance from the distal ventilatory opening. When properly placed with the distal tip and cuff in the upper esophagus and the ventilatory openings aligned with the opening to the larynx, the depth markings give an indication of the distance, in centimeters, from the vocal cords to the teeth.

(14) Confirm proper position by auscultation, chest movement, and verification of CO_2 by capnography, if available.

(15) Readjust cuff inflation to just seal volume (cuffs inflated with minimum volume necessary to seal the airway at the peak ventilation).

f. **Removal of the KING LT-D.**

(1) Once it is in the correct position, the KING LT-D is well tolerated until the return of protective reflexes.

(2) KING LT-D removal should always be carried out in an area where suction equipment and the ability for rapid intubations are present.

(3) For KING LT-D removal, completely deflate both cuffs.

NOTE: It may require more than one filling of the syringe to achieve complete evacuation of the KING LT-D cuffs.

Section III. ENDOTRACHEAL TUBE

2-12. INTRODUCTION

An endotracheal tube (ET) is a tube inserted into the trachea for administration of anesthesia, maintenance of an airway, aspirations of secretions, ventilation of the lungs, or prevention of the entrance of foreign material into the tracheobronchial tree. The two types of ETs dealt with in this lesson are the orotracheal tube and the nasotracheal tube. The orotracheal tube is inserted through the mouth into the trachea. The nasotracheal tube is inserted through the nose into the trachea. In this lesson, both the orotracheal tube and the nasotracheal tube are used to establish an airway.

2-13. ADVANTAGES/DISADVANTAGES OF ET

a. **Advantages of ET.** The chief advantage is that the endotracheal tube provides an unobstructed airway if the tube is properly placed. Air is channeled through the larynx and trachea to the lungs where it is needed. In normal breathing, some air breathed remains in the larynx and trachea where the air is unused. The space holding the unused air is called anatomic dead space and the endotracheal tube reduces that space by about 50 percent. Once inserted, the ET prevents the casualty from breathing in secretions such as blood, stomach contents, and bowel contents. The ET also makes positive pressure breathing (assisted or controlled) easier without gastric inflation.

b. **Disadvantages of ET.** With the ET in place, air goes directly through the mouth without being warmed, humidified, or filtered--all of which normally take place in the nasal passages. It is possible to cause further injury to the casualty by accidentally inserting the tube into the wrong area. A tube inserted into the esophagus, for example, can cause the airway to be completely obstructed. Also, the presence of the tube may be such an irritant to the casualty's body that the casualty may have breathing problems. The tube may cause bronchial spasms or increase the production of mucous; both make it more difficult for air to reach the casualty's lungs.

2-14. INDICATIONS/CONTRAINDICATIONS FOR USE OF ET

a. **Indications.** Indications for using the endotracheal tube are the same as for using the esophageal obturator airway -- casualty in deep coma, casualty with shallow respirations, casualty has progressive cyanosis, or casualty has cardiopulmonary arrest. Additionally, use the ET when preparing a person before surgery for anesthesia. The ET is used in all types of surgery where the casualty's position makes it impossible to use a mask; for example, the prone (lying face downward), lateral (lying on side with top knee bent for balance), and sitting positions. The ET is used if a tight mask fit is not possible due to "atypical" (abnormal) facial contours caused by disease, obesity, and so forth.

b. **Contraindications.** Do not use the endotracheal tube if there is upper airway obstruction due to foreign bodies. Use the endotracheal tube with caution if there is swelling in the larynx or if the patient has mandibular (horseshoe-shaped bone forming the lower jaw) or cervical (neck) fractures. Attempts at intubation may make these injuries worse.

2-15. INTUBATING WITH AN ET

a. **Equipment.** Endotracheal tubes are nontoxic, nonallergenic, and flexible. These tubes are able to maintain a curved shape and do not conduct electricity. There are two types of tubes: rubber tubes and plastic tubes. Rubber tubes include the Murphy, a blunt level type of endotracheal tube with an inflatable cuff. The Cole, a pediatric tube, is also made of rubber. Plastic tubes can be either opaque or transparent; the Protex is an example of such a tube. The Protex tube is made of transparent vinyl plastic; the tube tends to bend although it is somewhat rigid.

(1) Tube size.

(a) Measure the external diameter of the tube in millimeters.

(b) The internal diameter is measured in millimeters. The internal diameter size is basically standard but may vary by about 0.5mm.

(c) To determine the length of the oral tube, measure the distance from the corner of the casualty's mouth to midsternum (mid breast bone).

(d) The casualty's nare size will determine the nasal tube's diameter. To determine the length of the nasal tube, measure the distance from the earlobe to the corner of the mouth and add the distance from the corner of the mouth to the midsternum. The radius of the curvature is greater for oral tubes. The bevel for the nasal tube has a sharper angle than for the oral tubes. There is also a difference in the inflatable cuffs.

(2) Inflatable cuffs. These are used to attain an airtight seal to prevent aspiration. The cuffs should be inflated so the balloon indents with thumb pressure. Such indentation usually occurs when the balloon has been inflated with five to ten milliliters of air.

(3) Stylet. The stylet allows the proper tube curvature to be maintained.

(4) Magill forceps. These are used to guide the nasal endotracheal tube into the larynx from the pharynx.

(5) Laryngoscope. This device is used to see the larynx. A laryngoscope has two different types of blades: the Miller blade (which is straight) and the MacIntosh blade (which is curved). The component parts are:

(a) Handle. The "L" type or right angle is the most commonly used handle. Handles come in small, medium, and large sizes.

(b) Flashlight and penlight batteries.

(c) A blade that snaps onto the handle.

b. **Complications.**

(1) In the process of inserting the tube, teeth may be broken or chipped; nasal, oral, and pharyngeal soft tissue may be damaged; or the vocal cords may be damaged.

(2) The tube may be accidentally pushed into the esophagus, causing a total airway obstruction and finally death if the situation is not corrected.

(3) If the tube is pushed into the bronchus (either of the two main branches of the trachea), the casualty may suffer pneumothorax, bronchospasm, laryngospasm, hypoxemia, cardiac arrhythmias, or irritation of the carina with subsequent coughing.

(4) Endotracheal tube obstruction may be caused by foreign bodies, mucous, and so forth blocking the tube.

(5) The trachea or vocal cords may become ulcerated because of increased pressure by the ET cuff.

(6) After the endotracheal tube is removed, the casualty may experience laryngospasm (spasmodic closure of the larynx), infection, and hoarseness (sore throat).

2-16. PROCEDURAL STEPS FOR INTUBATING--OROTRACHEAL TUBE

Complete the following steps to intubate correctly:

a. Gather the equipment and check it.

(1) Tube. Select the type (vinyl, rubber, or plastic) and the size of the tube. Use anatomy considerations and measurements in your selection. (The inflatable cuff comes with the tube.)

(2) Stylet.

(3) Magill forceps. These forceps can be used to advance the tube between the vocal cords.

(4) Laryngoscope. Check this instrument for batteries and check the light. Select the blade you are going to use and assemble the blade. (The curved blade provides more working space, but the straight blade allows you to see better.)

(5) Suction apparatus with a tonsillar tip.

(6) J-tube (oropharyngeal) airway. A J-tube is a white plastic or black rubber tube that is used to keep the tongue out of the way.

(7) Anesthetic spray, if available.

b. Place the equipment next to the casualty's head, where the equipment is needed.

c. Position the casualty so that you have the best possible view of the larynx. The casualty should be in a "sniffing" position with a towel under his neck.

d. Turn on the suction apparatus.

NOTE: OPTIONAL PROCEDURE--Place a stylet into the tube prior to oxygenation and insertion of the laryngoscope.

e. Check the casualty's corneal reflex and his gag reflex, then oxygenate the casualty with two slow breaths. Check the casualty for the presence of a corneal reflex by touching the casualty's cornea with your fingers. If the eyelid does not try to close, continue with the procedure. If the eyelid tries to close (blink), the gag reflex is still present and you cannot proceed with insertion of the device. Periodically recheck for the reflex. When the eyelid does not try to close, continue with the procedure.

f. Insert the laryngoscope and place the tube.

(1) Grasp the laryngoscope with your left hand.

(2) Insert the laryngoscope into the right side of the casualty's mouth.

(3) Bring the blade to the center or midline of the mouth, moving the tongue to the left side.

(4) Advance the blade a short distance.

(5) Visualize the epiglottis.

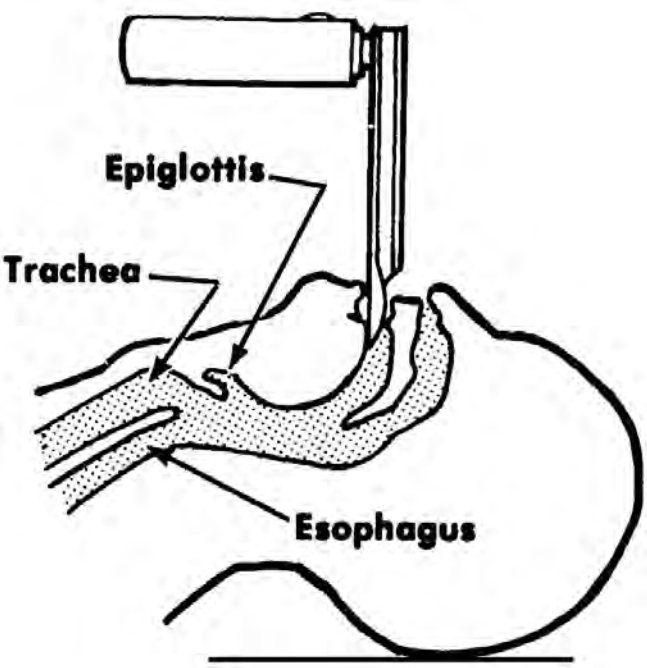

Figure 2-6. Placement of the laryngoscope.

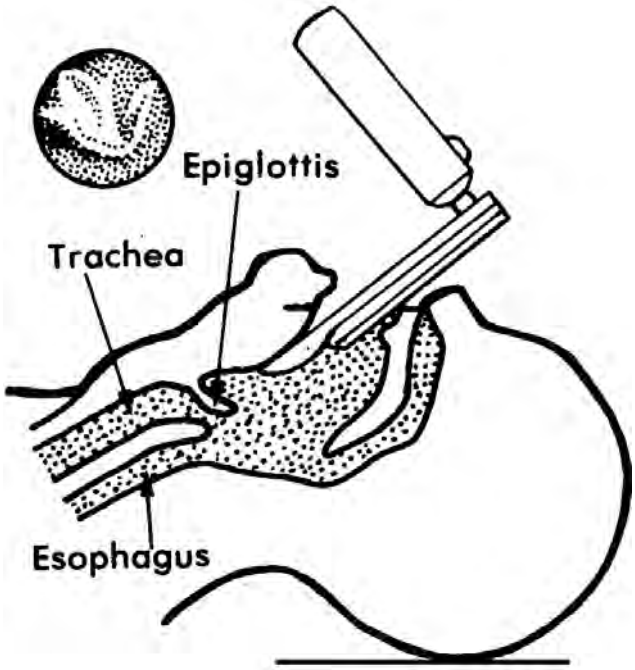

Figure 2-7. Visualization of the epiglottis.

(6) Advance the tip of the blade and lift it to visualize the vocal cords. If you are using a straight blade, place the tip of the blade under the epiglottis. If you are using a curved blade, put the tip of the blade on the vallecula (depression between the epiglottis and the root of the tongue, either side of the median glossoepiglottic fold).

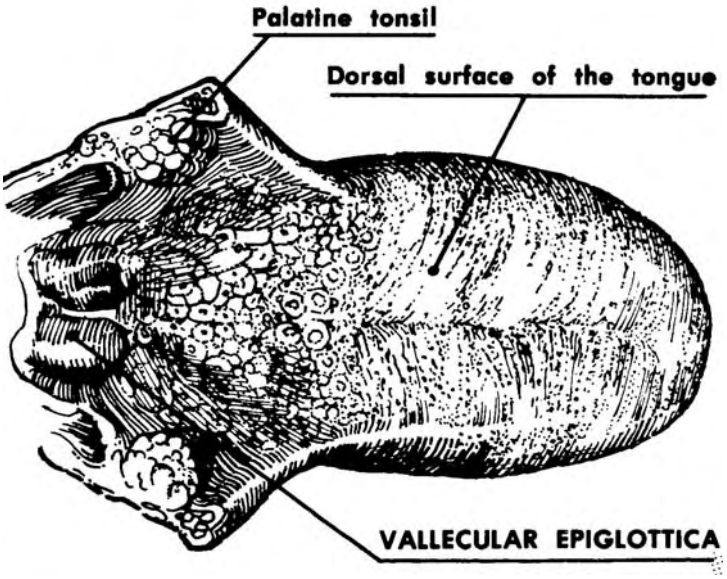

Figure 2-8. Vallecula epiglottica.

(7) Grasp the tube with the right hand.

(8) Advance the tip of the endotracheal tube carefully between the vocal cords until the upper cuff is below the level of the vocal cords.

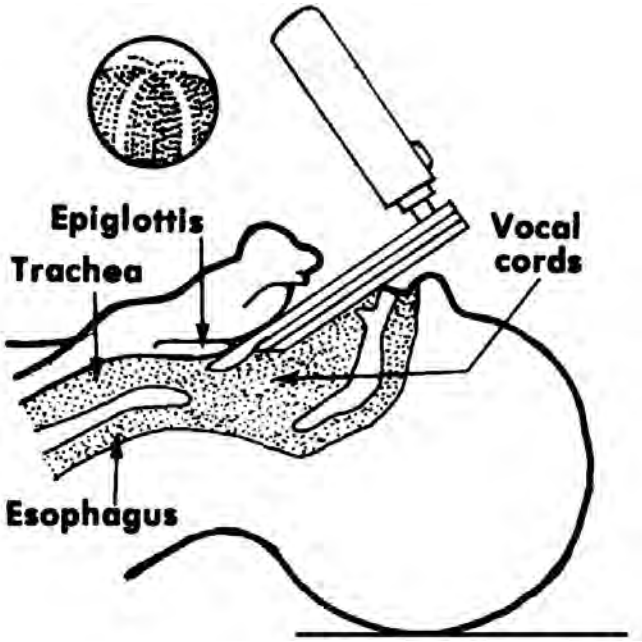

Figure 2-9. Visualization of the vocal cords.

(9) Insert the oropharyngeal airway (J-tube) to act as a bite block.

g. Check the placement of the endotracheal tube. To check the placement:

(1) Breathe through the tube while someone auscultates the two lower lung fields and the paraumbilical (area alongside the navel) regions to check tube placement.

(2) If sound is heard over one lung field (usually the right) more than the other, you must back up the tube a little and listen again.

NOTE: If a rushing sound is heard over the abdomen with diffuse sound over the lower lung fields, you have missed the larynx and gone down into the pharynx. You should remove the tube, reoxygenate the casualty, wait three minutes, and try again.

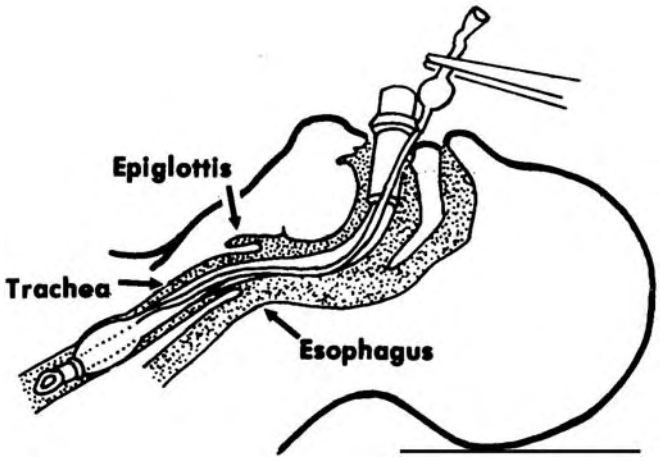

Figure 2-10. Properly placed endotracheal tube.

h. Inflate the cuff with 5 to 10 ml of air.

i. Reoxygenate the patient with two slow breaths.

j. Clamp the tube (optional) and remove the syringe.

k. Connect the resuscitative equipment (bag-valve-mask or O_2 with demand valve).

l. Ventilate once every 5 seconds.

m. Secure the tube.

n. Monitor the casualty periodically with auscultation to be sure the endotracheal tube is placed correctly.

CAUTION: Be sure the casualty is NOT without oxygen for longer than 30 seconds at a time. This is true for any airway procedure.

2-17. PROCEDURAL STEPS FOR INTUBATING--NASOTRACHEAL TUBE

a. Intubate with a nasotracheal tube in the same way as you would with an orotracheal tube. There are some differences, which are listed below.

b. Use the most patent nare. That is, insert the tube in the nostril which is the most open.

c. Advance the tube while you listen to breath sounds.

d. Use the Magill forceps to advance the tube into the larynx. Begin using the forceps when the tube appears in the oropharynx.

e. Be sure the bevel of the tube is adjacent to the nasal septum when the tube is being advanced.

f. Tape the tube across the casualty's nose and cheek on the side that is used.

2-18. EXTUBATING AN ET

The procedure is the same for the nasotracheal tube and the orotracheal tube. Follow these steps.

a. Suction the bronchial tree as required:

(1) Initiate cardiac monitoring.

(2) Preoxygenate for at least 3 minutes.

(3) Advance the catheter as far as possible with the suction off.

(4) Apply intermittent suction while slowly withdrawing the catheter in a rotating fashion.

(5) DO NOT apply suction for more than 5 seconds.

b. Reoxygenate the patient with two slow breaths.

c. Deflate the cuff using the syringe.

d. Remove the tube at the end of inspiration (inhaling).

e. Clear and maintain an open (patent) airway.

Continue with Exercises

EXERCISES, LESSON 2

INSTRUCTIONS. Answer the following exercises by writing the answer in the space provided.

After you have completed all of these exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers. For each exercise answered incorrectly, reread the material referenced with the solution.

1. List two advantages of using a nasopharyngeal airway.

   _____

   _____

2. What method is used to select to appropriate sized NPA?

   a. Measure the length from the tip of the ear to the corner of the mouth.

   b. Measure the diameter by comparing it to the size of the patient's pinky finger.

   c. Measure the length from the top of the nose to the corner of the ear.

   d. Measure the diameter by comparing it to the size of the patient's pointer finger.

3. List the two common sizes for the Combitube airway.

   _____ _____

4. List the contraindications for the Combitube airway.

   _____

   _____

   _____

   _____

5. How should the KING LT-D airway be lubricated?

   a. Lubricate liberally to ensure ease of insertion.

   b. lubricate sparingly because the airway has mucous which will ease insertion.

   c. Lubricate the length of the airway to help ease passage of the tube.

   d. Lubricate only the posterior surface to prevent excess lubrication being aspirated by the patient.

6. One possible complication of using an endotracheal tube is that the casualty may develop _____ of the trachea or vocal cords.

7. List the common sizes of the KING LT-D airway.

   _____ _____ _____

8. The chief advantage of the endotracheal tube, if properly placed, is that it provides _____.

9. If an endotracheal tube is in the casualty, air goes directly through the mouth and is not warmed, _____ , or _____ (functions normally performed by the nasal passages).

10. When you are using an endotracheal tube, determine the length of the tube by measuring the distance from the casualty's _____ and adding the distance from _____.

11. It is possible to cause damage when inserting an endotracheal tube; for example, teeth may be _____ or _____.

12. You are intubating with an orotracheal ET and hear a rushing sound over the abdomen along with sounds over the lower lung fields. You have missed the _____ and gone into the _____.

13. When intubating with an orotracheal ET, be sure the casualty does not go without oxygen for more than _____ at a time.

14. When intubating with a nasotracheal ET, be sure the _____of the tube is adjacent to the nasal septum when the tube is being advanced.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 2

1 You are correct if you listed any of the following.
Ease of placed in the nasal passage
Does not elicit a gag reflex.
Stays in place fairly well with little additional observation. (para 2-2)

2. b (para 2-4a)

3. 37 Fr; 41 Fr (para 2-8)

4. Intact gag reflex.
Casualties less than 5 feet in height.
Known esophageal disease.
Caustic substance ingestion. (para 2-9b)

5. d (para 2-11d(3))

6. Ulceration. (para 2-15b(5))

7 Size 3 -- 60 ml
Size 4 -- 80 ml
Size 5 -- 90 ml (para 2-11e(2))

8. An unobstructed airway. (para 2-13a)

9. Humidified, or filtered. (para 2-13b)

10. Earlobe to the corner of the mouth.
Corner of the casualty's mouth to the midsternum. (para 2-15a(1)(d))

11. Chipped or broken. (para 2-15b(1))

12. Larynx.
Pharynx. (para 2-16g(2) NOTE)

13. 30 seconds. (para 2-16n CAUTION)

14. Bevel. (para 2-17e)

End of Lesson 2

LESSON ASSIGNMENT

LESSON 3	Cricothyroidotomy
LESSON ASSIGNMENT	Paragraphs 3-1 through 3-7.
LESSON OBJECTIVES	After completing this lesson, you should be able to:

3-1. Define cricothyroidotomy.

3-2. Identify conditions requiring a cricothyroidotomy, types of cricothyroidotomy, and complications of cricothyroidotomy.

3-3. Identify signs/symptoms of an obstructed airway.

3-4. Place the steps of performing a surgical cricothyroidotomy in the correct order of performance.

SUGGESTION After completing the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 3

CRICOTHYROIDOTOMY

Section I. GENERAL CONSIDERATIONS

3-1. DEFINITION

A cricothyroidotomy is an emergency surgical procedure to provide a temporary airway between the cricoid cartilage and thyroid cartilage because there is a total obstruction in the normal oropharyngeal air-exchange route. The cricothyroidotomy site consists of the larynx, which contains the thyroid cartilage (Adam's apple); the cricoid cartilage; the cricothyroid membrane (between the cartilages); the thyroid gland; and the vocal cords. In a needle cricothyroidotomy or a surgical cricothyroidotomy, the cricothyroid membrane is penetrated. Figure 3-1 shows the location of the cricothyroid membrane.

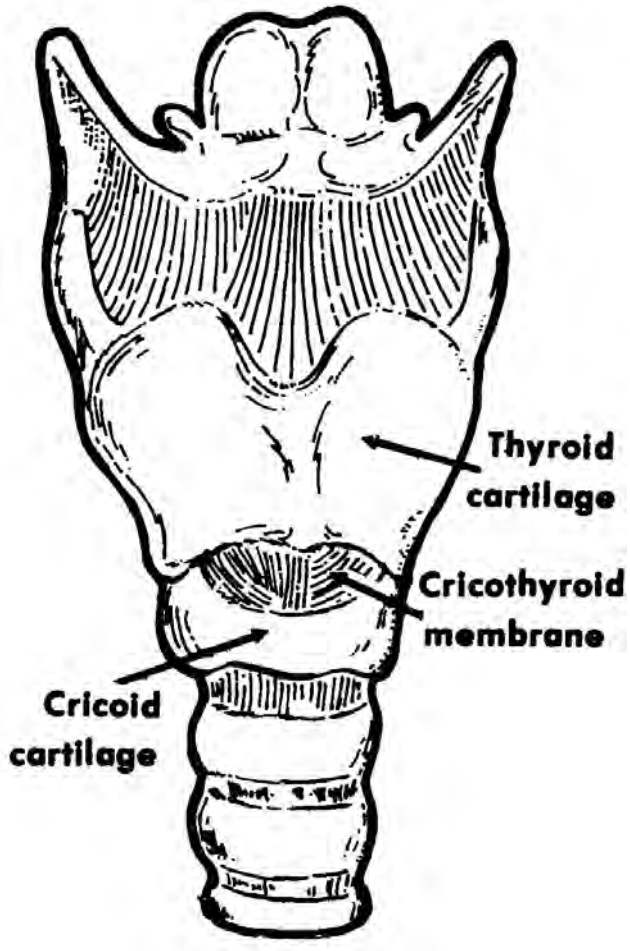

Figure 3-1. Location of the cricothyroid membrane.

3-2. CONDITIONS REQUIRING CRICOTHYROIDOTOMY

a. **Trauma to the Larynx.** A blow to the larynx with a blunt instrument can cause destruction of the structure that supports the larynx. This allows the airway to collapse during inspiration (breathing in) and to close. A blow to the larynx with a blunt object may cause severe swelling (edema). This swelling may result in the airway becoming closed. This swelling may not occur for up to 48 hours following the injury. Monitor a casualty with possible or suspected injury to the larynx constantly during the period immediately following such an injury.

b. **Foreign Bodies/Objects.** Foreign bodies include dislocated teeth or dentures or accumulations of blood, mucus, or vomitus. Foreign objects that are accidentally ingested and obstruct the airway may be the greatest cause of upper airway obstruction. In very young children, foreign objects in the airway may be the result of not knowing how to chew and swallow properly or an underdeveloped epiglottal reflex. In adults, airway obstruction is frequently associated with eating coarse meats and vegetables. Airway obstruction in adults is often misdiagnosed as a heart attack (cafe coronary), but the person is really suffering from something obstructing the airway.

c. **Soft Tissue Involvement.** Soft tissue involvement may cause swelling that results in the airway being obstructed. Possible reasons for the swelling include an anaphylactic reaction or flash burns involving trauma to the larynx.

3-3. COMPLICATIONS

Although a cricothyroidotomy is a relatively safe procedure, complications can occur. Bleeding is the most common complication, but it is usually minor and controllable. False passage (that is, accidentally entering a passage other than the airway) is another complication. Complications also include damage to the vocal cords and larynx (if the incision is made incorrectly), mediastinal emphysema, subcutaneous emphysems, and infection.

CAUTION: Resuscitation techniques may be necessary. In such a case, use a bag-valve-mask, demand valve resuscitator, and suction device.

3-4. SIGNS/SYMPTOMS OF AN OBSTRUCTED AIRWAY

The absence of respiration, universal choking sign, and inability to speak are all signs/symptoms of an obstructed airway. On looking at the casualty, you may see that his chest is fully expanded with the rib margins being prominent while the intercostal spaces are depressed. Another sign is slightly bluish discoloration of the skin and mucous membrane because of oxygen deficiency (cyanosis).

Section II. SURGICAL CRICOTHYROIDOTOMY

3-5. GENERAL

A surgical cricothyroidotomy is the first treatment action when the airway is obstructed by swelling associated with burns, anaphylactic reaction, edema, or a crushing injury to the larynx. IT IS THE LAST RESORT FOR ALL OTHER TYPES OF OBSTRUCTION. This task should NOT be performed on infants and children. Only casualties with a total upper airway obstruction or casualties with inhalation burns should be considered for surgical cricothyroidotomy.

3-6. EQUIPMENT

To perform surgical cricothyroidotomy, you will need the following equipment.

a. Any cutting instrument such as:

(1) Scissors.

(2) Pocket knife.

(3) Tin can (edge).

(4) Scalpel.

b. If a dilator (an instrument used for stretching an opening) is not available, you may use one of the following to enlarge the opening.

(1) Hemostats (small surgical clamp for constricting a blood vessel).

(2) Needle holders.

(3) Small retractors (Weitlaner).

(4) Knife handle.

(5) Pair of keys.

(6) Cannula (noncollapsible tube to maintain airway).

c. Tape or something to hold the tube in place.

3-7. PROCEDURE

This procedure must be performed within four minutes.

a. Place the casualty in the supine position with the neck straight and slightly hyperextended. If you suspect that a casualty has a cervical injury, do not hyperextend the neck. Place a large, rolled-up towel under the casualty's neck or between the shoulder blades so the airway is straight.

b. Locate the cricothyroid space. To do this, palpate the thyroid cartilage (Adam's apple) with the index finger of one hand. Slide the finger down until you feel the cricothyroid space. (The cricoid cartilage is next.)

c. Move the finger upward to the cricothyroid space and cleanse the area. (Cleansing the area may not be possible in a field situation.)

d. Using your index finger and thumb, raise a tent of skin overlying the cricothyroid space.

e. With the cutting instrument in your other hand, make a 1 1/2-inch incision, in line with the trachea, through the tented skin down to the cricothyroid space.

f. Reidentify the cricothyroid space by touch and sight.

g. Stabilize the larynx with one hand and make a 1 1/2-inch horizontal incision through the elastic tissues of the cricothyroid membrane.

h. Insert the dilator through the opening.

i. Separate the blades of the dilator to make a larger opening. A rush of air through the opening may be noted.

j. Insert the end of the cannula between the blades of the dilator. The cannula should be in the trachea and directed toward the lungs.

k. Secure the cannula in place to reduce the movement in the opening and to keep the casualty from inhaling the cannula. You may perform mouth to cannula resuscitation, if necessary. Inserting the cannula may stimulate reflex coughing. This may aid in clearing the airway, but it is still important to secure the cannula properly.

l. Suction using the following procedure. Insert the suction catheter 4 to 5 inches into the cannula. Then, apply suction only when you are withdrawing the catheter. One cubic centimeter of saline solution may be introduced in the airway to loosen secretions and make suctioning easier. Always allow the casualty to take breaths between efforts to suction.

m. Make a y-shaped cut in a 4-inch by 4-inch gauze pad. Place it under the edge of the cannula to prevent irritation to the casualty. (Fold the pad when placing it under the cannula; do not cut the pad at this point.)

n. Place a saline-moistened 4-inch by 4-inch gauze pad over the cannula opening to provide moisture in the airway.

Continue with Exercises

EXERCISES, LESSON 3

INSTRUCTIONS. Answer the following exercises by writing the answer in the space provided or by selecting the lettered response that best meets the requirement of the exercise .

After you have completed all of these exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers. For each exercise answered incorrectly, reread the material referenced with the solution.

1. A cricothyroidotomy can provide a temporary airway between the _____ and the _____when there is a total airway obstruction.

2. List the five parts of the cricothyroidotomy site.
   a. _____.
   b. _____.
   c. _____.
   d. _____.
   e. _____.

3. List three reasons a person might need a cricothyroidotomy.
   a. _____.
   b. _____.
   c. _____.

4. Signs and symptoms of an obstructed airway include absence of _____, universal _____ signs, and inability to _____.

5. Although a cricothyroidotomy is a relatively safe procedure, complications include bleeding, entering a passage other than the airway, and damaging the_____ and the larynx.

6. In the procedure of surgical cricothyroidotomy, a dilator is used to _____.

7. In a surgical cricothyroidotomy, the horizontal incision through the elastic tissues of the cricothyroid membrane is _____ inches long.

8. These are the beginning steps in the procedure of performing a surgical cricothyroidotomy. The steps are not in the order in which you would do them. Choose the response which lists the steps in the correct order of performance.

    1. Raise a tent of skin overlying the cricothyroid space.
    2. Place the casualty in the correct position.
    3. Locate the cricothyroid space.
    4. Make a horizontal incision cutting down to the cricothyroid space.
    5. Move a finger upward to the cricothyroid space and cleanse the area.

    a. 3,2,1,5,4.

    b. 4,1,3,2,5.

    c. 1,4,2,3,5.

    d. 1,3,5,2,4.

    e. 2,3,5,1,4.

9. These are the continuing steps in the procedure of performing a surgical cricothyroidotomy. The steps are not in the order in which you would do them. Choose the response which lists the steps in the correct order of performance.

    1. Stabilize the larynx with one hand and make a 1/2 inch horizontal incision through the elastic tissues of the cricothyroid membrane.

    2. Insert the cannula end between the blades of the dilator.

    3. Insert the dilator, separating its blades to make a larger opening.

    4. Reidentify the cricothyroid space.

    5. Secure the cannula in place.

    a. 1,4,3,2,5.

    b. 4,1,3,2,5.

    c. 1,4,2,3,5

    d. 1,3,5,1,4.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 3

1. Cricoid cartilage, thyroid cartilage. (para 3-1)

2. Thyroid cartilage.
   Cricoid cartilage.
   Cricothyroid membrane.
   Thyroid gland.
   Vocal cords. (para 3-1)

3. Trauma to the larynx.
   Foreign bodies/objects obstructing the airway.
   Soft tissue involvement (swelling) obstructing the airway. (paras 3-2a, b, c)

4. Respiration, choking, speak. (para 3-4)

5. Vocal cords. (para 3-3)

6. Stretch the opening after the incision through the cricothyroid membrane is made. (para 3-6b)

7. 1 1/2 inches. (para 3-7g)

8. e (para 3-7a through 7e)

9. b. (para 3-7f through 7k)

End of Lesson 3